PATENT CLAIMS

1. A scanning probe microscope comprising a base frame (11), to which a probe holder (12) with a probe (13) as well as a sample mount (14) are attached or can be attached,

in which case the probe (13) and the sample mount (14) can be moved relative to one another in order to obtain information about the surface of the sample (15) by scanning a sample (15) which is arranged on the sample mount (14),

characterized in that a reaction chamber (16) can be attached to the base frame (11) of the scanning probe microscope, with the sample mount (14) arranged in it,

with the reaction chamber (16) having an opening (17) on its side facing the probe (13), through which the probe (13) can enter the reaction chamber (16).

2. The scanning probe microscope as claimed in claim 1, characterized in that a closure device (31), in particular a cover plate (18), is provided in order to make it possible to close the opening (17) after the probe (13) has been moved from a measurement position P_M to a withdrawn sample preparation position P_V.

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3. The scanning probe microscope as claimed in claim 2, characterized in that the withdrawn sample preparation position P_V can be reached, starting from preferably any desired measurement position, by movement of the probe and/or sample exclusively in the z direction (perpendicular to the surface), which is orthogonal with respect to the x and y directions.

4. The scanning probe microscope as claimed in one of claims 1 to 3 characterized in that the movement distance of the probe (13) relative to the sample is between 1 mm and 15 mm, preferably between 1 mm and 6 mm, and in particular between 1 mm and 3 mm.

5. The scanning probe microscope as claimed in one of claims 1 to 4, characterized in that the movement distance of the probe (13) relative to the sample is between 1 mm and 3 mm, and is produced by means of an actuator (41), in particular a piezoelectric actuator.

6. The scanning probe microscope as claimed in claim 5, characterized in that the actuator (41) is in the form of a piezoelectric actuator, a piezo-flexure positioning apparatus or a magnetic xy scanner or positioning apparatus, and is advantageously arranged between a micropositioning device (42), which is arranged on the base frame (11), and a scanning unit (43) which is connected to the probe holder (12).

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7. The scanning probe microscope as claimed in one of claims 1 to 6, characterized in that the reaction chamber (16) also has an inlet (20), in order to introduce fluid media, such as liquids, gases, particle flows and/or a plasma into the reaction chamber (16).

8. The scanning probe microscope as claimed in claim 7, characterized in that the reaction chamber (16) has an outlet (21), which is operatively connected to a suction device in order to pass liquids, gases, particle flows and/or plasmas via the inlet (20) through the reaction chamber (16).

9. The scanning probe microscope as claimed in one of claims 1 to 8, characterized in that a plasma generation device (22) is arranged on or in the reaction chamber (16) in order to allow a plasma to be produced within the reaction chamber (16).

10. The scanning probe microscope as claimed in claim 9, characterized in that the plasma production device (22) is designed to produce a plasma by inductive means.

11. The scanning probe microscope as claimed in claim 9 or 10, characterized in that the plasma generation device has a flat coil (23), in which all of the windings are arranged essentially on one plane, and a capacitor (30), which is formed radially-symmetrically or in a planar form.

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12. The scanning probe microscope as claimed in one of claims 9 to 11, characterized in that the plasma generation device (22) is in the form of a miniaturized, integrated radiofrequency circuit and, in particular, is in a planar form.

13. The scanning probe microscope as claimed in one of claims 9 to 12, characterized in that the plasma generation device (22) is operatively connected to a plasma monitoring system, with whose aid the power required to ignite and/or to operate the plasma generation device (22) is controlled.

14. The scanning probe microscope as claimed in one of claims 1 to 13, characterized in that at least two electrodes (24, 25) of opposite polarity are provided on the reaction chamber (16), in order to input energy capacitively.

15. The scanning probe microscope as claimed in one of claims 1 to 14, characterized in that the reaction chamber (16) has a volume of between 1 cm^3 and 10 cm^3, preferably of between 2 cm^3 and 5 cm^3.

16. The scanning probe microscope as claimed in one of claims 1 to 14, characterized in that the reaction chamber (16) has a volume of 10 cm^3 to 300 cm^3, in particular for the treatment of relatively large samples with an area of, for example, 40 mm × 40 mm.

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17. The scanning probe microscope as claimed in one of claims 1 to 16, characterized in that a conductor (26) is or can be passed into the reaction chamber (16) in order to make contact with the sample (15).

18. The scanning probe microscope as claimed in one of claims 2 to 17, characterized in that the closure device (31) has an actuator (32) which is driven hydraulically, pneumatically or mechanically and results in low-friction movements of the cover plate (18), avoiding oscillations.

19. The scanning probe microscope as claimed in claim 18, characterized in that the actuator (32) results in movement of the cover plate, in particular in a rotational or translational movement.

20. A reaction chamber module for installation in a scanning probe microscope having the features as claimed in one of claims 1 to 19.

21. The reaction chamber module as claimed in claim 20, characterized in that the reaction chamber module (29) essentially comprises the reaction chamber (16) itself.

22. The reaction chamber module as claimed in claim 20, characterized in that the reaction chamber module (29) comprises a reaction chamber base body (27) as well as a reaction chamber (16).

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23. The reaction chamber module as claimed in claim 22, characterized in that the reaction chamber module (29) can be inserted into a measuring table (26), which can be moved in the investigation plane (xy plane), or forms an integral unit with the measurement table (26), in particular as an interchangeable module for a chuck.

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24. A method for treatment and investigation of surfaces with the aid of a probe (13) of a scanning probe microscope and of a reaction chamber (16) which is installed in the scanning probe microscope, comprising the following steps:

a first scanning probe microscopic investigation of an area of a surface of a sample (15) which is arranged in an open reaction chamber (16) is carried out,

the probe (13) is withdrawn in a direction perpendicular to the surface, through a defined movement distance S from its measurement position P_M to a sample preparation position P_V,

the surface within the reaction chamber (16) is treated by the specific influence of a liquid, of a gas, of a particle flow and/or of a plasma over a predetermined reaction time,

the probe (13) is moved back from the sample preparation position P_V to the previous measurement position P_M or to a new initial position P_A in the direct vicinity of the previous measurement position.

25. The method as claimed in claim 24, characterized in that the relevant movement between the probe (13) and the sample (15) is carried out such that the previous measurement position P_M and the new initial position P_A are less than 600 nm apart from one another, preferably less than 200 nm apart from one another, and in particular less than 20 nm apart from one another.

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26. The method as claimed in claim 24, characterized in that the previous measurement position P_M and the initial position P_A are less than 0.04 parts per thousand, preferably less than 0.004 parts per thousand, in particular less than 0.0004 parts per thousand of the movement distance S, in which case the approximately constant increase in the distance for further treatment steps preferably increases by less than about 0.0035 parts per thousand, preferably less than 0.00035 parts per thousand, in particular less than 0.000035 parts per thousand of the movement distance S per treatment step.

27. The method as claimed in one of claims 24 to 26, characterized in that, before the treatment of the surface, the reaction chamber (16) is closed, and it is opened again before the probe (13) is moved back, in order to allow the probe (13) to enter the reaction chamber (16).

28. The method as claimed in one of claims 24 to 27, characterized in that a plasma is ignited and operated in the volume of the reaction chamber or in an adjacent chamber with a comparably large volume, in particular in a volume of 1 cm^3 to 10 cm^3.

29. The method as claimed in claim 24, characterized in that the method steps are carried out automatically with the aid of computer control.

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